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Title:

1.8 THz superconductive hot-electron bolometer mixer for Herschel

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Abstract:

We are currently building terahertz-frequency mixers for the heterodyne instrument aboard the Herschel Space Observatory. The mixers will employ a submicron superconductive niobium microbridge as the hot-electron bolometric mixer element and will operate at ~2 K. Rapid outdiffusion of hot electrons from 0.1 μm-long devices leads to the very high intermediate frequency bandwidths needed for practical spectroscopic observations. The mixer will be optimized for operation between 1.6 and 1.9 THz, the highest frequency band of the seven mixer channels on Herschel. The signal and LO are coupled quasioptically with a planar antenna on a dielectric lens. Initial measurements indicate that these mixers can be adequately pumped with a recently developed 1.5 THz solid-state local oscillator [1]. The primary performance requirements are sensitivity better than 1 K per GHz and an intermediate frequency bandwidth of 4 GHz, centered at 6 GHz. Both requirements have been previously demonstrated for this type of mixer, and our present challenge is to turn a very delicate laboratory detector into a rugged, space-qualified version that at the same time meets difficult optical interface requirements. One key area of our effort is to quantify and improve the reliability of the mixer, as it must withstand handling during integration and testing, numerous thermal cycles, and the spacecraft launch environment. It must also work properly throughout the mission lifetime of about 4 years. We will report on the current status of the flight mixer development.